Sub Theme : Biodiversity and Conservation
ISBN : 978-602-8915-93-9

THE LONGEVITY OF *Diaphorina citri* ON VARIOUS DOMINANT WEEDS

Siwi Hardiastuti, Mofit Eko Poerwanto*

Agrotechnology Department, University of Pembangunan Nasional "Veteran" Yogyakarta
*mofitnuk@yahoo.com, telp/fax: (0274) 487793

ABSTRACT

Citrus vein phloem degeneration (CVPD) is the most impediment disease in citrus production in the world. It mainly vectored by *Diaphorina citri* Kuwayama. Intensive application of insecticides is ineffective and also costly. Various weeds species in citrus orchard are suspected as alternative host of vector. Research on the longevity of *D. citri* on the various weeds is needed for completing the integrated CVPD disease management program. Each of five dominant weeds gained from vegetation analysis were exposed to five days old *D. citri* adults inside the nylon mesh cage, which previously starved for 24 hours. The number of *D. citri* survived was recorded daily (24 h). Analysis of variance and DMRT were done on data. Most of *D. citri* stayed for feeding on *Boerhavia erecta* and survived for 5.91 days. It was significantly different on *Amaranthus spinosus*, and also on *Althernanthera philoxeroides*, *Portulaca oleracea*, *Ludwigia perrenis* which survived for 3.57, 0.20, 0.00, and 0.20 days respectively.

Key words: CVPD, longevity, citrus, Diaphorina citri

INTRODUCTION

Citrus vein phloem degeneration (CVPD) is the most impediment disease in citrus culture in the world and has been attacking citrus in Asia and America (Aubert, 1990; Halbert & Majunath, 2004). Many highly productive plantations where yields were 20 tones per ha decreased sharply into 8.6-15 tones per ha per annum (Irawan *et al.,* 2003). Recently, citrus production in Indonesia has developed rapidly. In 2007, the production increased to 2,625,884 tones. However, CVPD is still a great threat to the citrus production in Indonesia. In 2008, the production decreased again into 2,467,632 tonnes (BPS, 2009).

CVPD mainly vectored by *D. citri* Kuwayama. Fourth and fifth instars as well as adults are able to transmit diseases (Xu et al, 1988; Aubert, 1990). Its role as the insect vector, led to the vector control using insecticides as the principal strategies in CVPD control management. However, significant result of the CVPD disease control has not yet been obtained in the field due to the insufficient understanding of the life of a vector. The existence of various weeds in citrus orchards could be suspected as alternative host of vector (*D. citri*). Some weeds are able as alternative host of pests and pathogens. Kolomento weeds (*Leersia hexandra*) and Sembungan (*Sacciolepis*

interrupta) are the host plants of rice stem borer, Cerulang (*Eleusine indica*) is the host plants of *Piricularia oryzae*, and nematodes *Rotylenchus reniformis*. Wuluhan (*Setaria plicata*) and Jajahean or Lempuyangan (*Panicum sp.*) are host plant of rice bug (Rukmana and Saputra, 1999). In order to complete an integrated control program of CVPD, research on *D. citri* longevity in various weeds species should be conducted.

MATERIALS AND METHOD

D. citri mass rearing

Eggs of D. citri was obtained from the field and maintaned on orange jasmine plants. The nymphs wich hatched from eggs reared on orange jasmine shoots, planted in pots (Ø 17 cm, height 12 cm and Ø 25 cm, height 18 cm) and covered with nylon mesh cages (length 100 cm, width 100 cm, height 100 cm).

Weeds identification and vegetation analysis of citrus orchards

Dominant citrus weeds was determined using analysis vegetation method by taking five ring samples (50 cm x 50 cm) per plots randomly on three citrus orchards. Values of ADe (absolute density), AF (absolute frequency), ADo (absolute dominance), RDe (relative density), RF (relative frequency), and RDo (relative dominance) were calculated and value of SDR (summed dominance ratio) was determined.

D. citri longivity test on weeds

Experiments were carried out by using five dominant weeds planted in pots. Each weed was inserted into nylon mesh cage (Ø 10 cm, height 30 cm) and 10 of five days old *D. citri* adults were released in the midle of the cage. They were previously starved for 24 hours before releasing. The cages were covered with sponge (Ø 10 cm, 2 cm thick). The number of *D. citri* survived on each weed was observed every 24 hours up to all of them in dead. The treatment was repeated 10 times.

Data analysis

Analysis of variance at 95% significance level was done by using SPSS 10.0.5 (SPSS, 1999) to determine the effect of treatment. Duncan's multiple range test (DMRT) at 95% significance level was carried out to identify significant difference between treatments (Gomez and Gomez, 1983).

RESULTS AND DISCUSSION

Results of vegetation analysis on weeds of citrus orchard found 16 species of weeds which consists of three species of grass, 10 species of broadleaf, and three species of sedges group (Table 1.). Based on these results, five most dominant weed species were taken for testing *D. citri* longevity; there were *Alternathera philoeroides* of grass group, *Oleraceae Portulaca, Amaranthus spinosus, Ludwigia perrenis,* and *Boerhavia erecta* of broadleaf weeds with SDR values of 19.72%, 12.06%, 11.65%, 9.31% and 6.93% respectively. The analysis result also shows that the value of absolute density (ADe) was not necessarily generating high values of SDR, because the value of SDR was determined by three parameters: density (De), dominance (Do), and frequency (F). The highest value of SDR on *A. philoeroides* indicated that this weed was the most dominant weeds in the field.

D, citri was able to survive a maximum of eight days with the mean longevity of 5.91 ± 0.251 days on the broadleaf weed *B. erecta*, but was not able to complete one life cycle (Figure 1.). It was significantly different to other weeds, *A. spinosus, A. philoeroides, L. perrenis* and *P. oleraceae* which were survived for 3.57, 0.20, 0.20 and 0.00 days respectively (Table 2.).

Table 1. Vegetation analysis on weeds of citrus orchards

Weeds species	Group	Ade	AF	ADo	RD	RF	RD	SDR(%)
*Alternathera philoeroides**	G	15	3	20,5	14,29	12	32,87	19,72
Digitaria longiflora	G	4	1	2,6	3,81	4	4,17	3,99
Physalis angulata	B	1	1	0,6	0,95	4	0,96	1,97
Cyperus iria	S	4	2	1,3	3,81	8	2,08	4,63
*Amaranthus spinosus**	B	14	3	6	13,33	12	9,62	11,65
Ageratum conyzoides	B	5	1	3,7	4,76	4	5,93	4,90
*Ludwigia perrenis**	B	12	3	2,8	11,43	12	4,49	9,31
Eclipta prostrata	B	1	1	0,6	0,95	4	0,96	1,97
Borreria leavis	B	2	1	1,2	1,91	4	1,92	3,27
Eleusine indica	S	5	1	6,1	4,76	4	9,78	6,18
Phylanthus debilis	B	3	2	0,7	2,86	8	1,12	3,99
*Boerhavia erecta**	B	6	1	6,9	5,71	4	11,06	6,93
*Portulaca oleraceae**	B	21	2	5,1	20,0	8	8,18	12,06
Euphorbia hirta	B	2	1	0,2	1,91	4	0,32	2,08
Pentella repens	G	8	1	3,9	7,62	4	6,25	5,96
Hedrotis corymbasa	S	2	1	0,1	1,91	4	0,16	2,02
Total		105	25	62,4	99,99	100	99,89	100,6

Notice : ADe (absolute density), AF (absolute frequency), ADo (absolute dominance), Rde (relative density), RF (relative frequency), and RDo (relative dominance), SDR (summed dominance ratio), * (five most dominance weeds), G (grass), B (broad leaf), S (sedge)

The ability to survive in non host plants indicated the existence of nutrients content in the weed that resembles its host plant nutrient content or the existence of certain substances that could stimulate *D. citri* to stay for feeding. The substances could be a various compounds of alcohol and aldehyde from the leaves of which were specific and volatile used by insect to find its host plant (Visser, 1986). However, the type and number of nutrient content was not as complete as in the host plant for surviving and completing a life cycle. Similar results were also obtained by Sudiono and Purnomo (2008) in Gemini virus isect vectors (*Bemecia tabaci*), and Hardiastono (2001) on Peanut Stripe Virus (PStV). *B. tabaci* were able to live on broadleaf weed *Ageratum conyzoides*. The weeds also serve as a source of inoculum since they were able to be infected by Gemini virus. While *Amaranthus spinosus, Bidens pilosa, Crotalaria incana, Glycine max* and *Physalis angulata* as alternative hosts and source of inoculums for PStV infection.

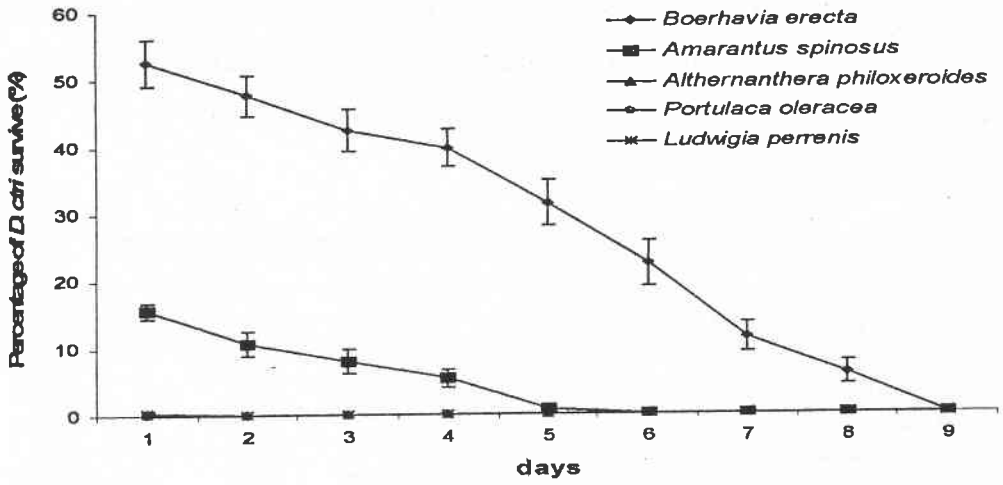

Figure 1. Percentage of *D. citri* survived on various dominant weeds

Table 2. The mean of longevity (days) of *D. citri* on various dominant weeds

Weeds species	Mean ± SE	
Boerhavia erecta	5,91 ± 0,251	a
Amaranthus spinosus	3,57 ± 0,292	b
Alternathera philoeroides	0,20 ± 0,200	c
Portulaca oleraceae	0,00 ± 0,000	c
Ludwigia perrenis	0,20 ± 0,200	c

Numbers followed by the same letter are not significantly different between treatments ($P < 0,001$)

Some of *D. citri* population (31%), obviously did not prefer to stay for feeding on any weeds treatments and just stayed on the cage. Presumably they did not recognize these five kinds of weeds as a host that can be used as a food source. While the absence of *D. citri* population on *P. Oleracea* likely could be caused by high water content in this weeds, which were structurally quite different from their host plants (citrus). The high water content also causes the low content of volatile compounds (specific odors) which were emitted, and were unable to attract *D. citri* stayed for feeding.

The implications of those survivorships of *D. citri* in some weed species is the presence of alternative host for *D. citri* when citrus plant is not available as a food source, either because there are no plants or when plants are treated with pesticides. The existence of alternative host will cause the population of *D. citri* is available throughout the season and serve as initial population for the next generation population. Role of *D. citri* as a propagative vector of CVPD pathogen will also make the disease inoculums always available throughout the season in field. This will further complicate the control measures against CVPD on citrus plant, since the disease transmission is highly dependent on the availability of disease inoculums and insect vector population in the field (Chen, 1998).

CONCLUSION

1. Weeds were able as an alternative host for *D. citri.*
2. The mean of longevity of *D. citri* on broad leaf weeds *Bhoeravia erecta* was 5.91 ± 0.251 days.

REFERENCES

Aubert B. 1990. Integrated activities for the control of *Huanglongbing*-greening and its vector *Diaphorina citri* Kuwayama in Asia. *In*: Aubert B, Tontyaporn S, Buangsuwon D (eds). Proceedings of the Fourth International Asia Pacific Conference on Citrus Rehabilitation, Chiang Mai, Thailand, 4-10 February 1990. Rome: FAO UNDP. pp133-144.

BPS. 2009. Produksi buah-buahan di Indonesia. http://www.bps.go.id/tab_sub/view.php? tabel=1&daftar=1&id_subyek= 55& notab=2

Chen CN. 1998. Ecology of the insect vectors of citrus systemic diseases and their control in Taiwan. Food & fertilizer technology center. www.agnet.org/library/data/eb/eb459a/eb459a.pdf

Gomez KA, Gomez AA. 1983. Statistical procedures for agricultural research. Second edition. John Wiley and Sons. New York. 680 pp.

Halbert SE, Manjunath KL. 2004. Asian citrus psyllids (Sternorrhyncha: Psyllidae) and greening disease of citrus: a literature review and assessment of risk in Florida. Florida Entomologist 87: 330-353.

Hardiastono, T. 2001. Potensi gulma berdaun lebar pada pertanian kacang tanah (Arachis hypogaea L.) sebagai inang alternative penyakit bilur peanut stripe virus (PStV). Habitat. 12 (3): 139-146

Irawan IGP, Sulistyowati L, Wijaya IN. 2003. Penyakit CVPD Pada Tanaman Jeruk (Analisis Baru Berbasis Bioteknologi). Dirjen Perlindungan Hortikultura.

Rukmana dan Saputra. 1999. Gulma dan Teknik Pengendalian. Kanisius. 88 pp.

SPSS Inc. 1999. SPSS® for Windows™ Version 10.0.5. Chicago: SPSS Inc.

Sudiono dan Purnomo. 2008. Studi kisaran inang kutu kebul (*Bemisia tabaci* Genn.) di sentra sayuran dataran tinggi tanggamus. Jurnal Penelitian Terapan. 8 (3): 103-108.

Visser, JH. 1986. Host odor perception in herbivores insects. Annual Reviews of Entomology. 31, 121-144

Xu CF, Xia YH, Li KB, Ke C. 1988. Further study of the Transmission of citrus *Huanglongbing* by a psyllid *Diaphorina citri* kuwayana. Proceeding of 10th Conference of IOCV. Riverside. pp.243-248